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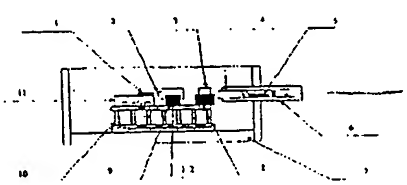
[54]实用新型名称 半导体激光器输出的光学耦合装置

[57]摘要

一种半导体激光器输出的光学耦合装置,具有两个透镜,一个用于收集发射光并准直,第二个用于聚焦并连接光纤头;在第一和第二透镜之间有一个光学隔离器,使光纤内的反射和散射光不能进入激光器,提高激光器的稳定性和信号-躁声比。



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权 利 要 求 书

1、一种半导体激光器输出的光学耦合装置，具有两个透镜，第一个用于收集发射光并准直，第二个用于聚焦并连接光纤头；其特征在于使用两个光学透镜，并且透镜之间有一个光学隔离器。

2、如权利要求1所述的半导体激光器输出的光学耦合装置，其特征在于所说的第一和第二个透镜是自聚焦透镜，透镜的周期分别为0.18和0.23。

3、如权利要求1所述的半导体激光器输出的光学耦合装置，其特征在于所说的所说的第一个透镜是球透镜或非球面透镜。

4、如权利要求1所述的半导体激光器输出的光学耦合装置，其特征在于所说的所说的各光学元件的定位用激光焊接。

5、如权利要求1所述的半导体激光器输出的光学耦合装置，其特征在于所说的所说的所说的第二个透镜的出射面和光纤端面的倾角相同。

6、如权利要求5所述的半导体激光器输出的光学耦合装置，其特征在于所说的倾角是6-9度。

7、如权利要求1所述的半导体激光器输出的光学耦合装置，其特征在于激光输出经过的各光学表面镀与激光器波长相应的增透膜。

说　　明　　书

半导体激光器输出的光学耦合装置

本实用新型属于光纤通信领域，更进一步说是属于半导体激光输出和光尾纤之间的光学耦合装置。

光纤通信领域中普遍使用半导体激光器作为发射源，它是光通信系统中将电信号转化为光信号的关键器件，在光通信技术中占有举足轻重的地位。半导体激光器的输出光有较大的发散角，输出的光与光尾纤之间必须要有一个光学耦合的装置，这种光学耦合封装又是关系到整个器件性能的重要技术。特别是对于光通信用的高速分布反馈式（DFB）激光器模块，对于光谱和信号的稳定性要求很高。对于这个光学耦合装置的普遍要求是：激光器的输出光，也就是信息光波尽可能多地耦合进入光纤；后向散射光和反射光尽可能少地反向耦合回激光器。通常的半导体激光器输出偶合装置是用光学透镜，用于光束的会聚。也有的耦合装置要用两个透镜，一个用于光的准直，另一个用于光的聚焦。但是我们发现用这种双透镜的激光输出耦合装置，一般稳定性不好，加工工艺难于控制，而且光纤内的反射光会进入激光器，影响激光器工作的稳定性。本实用新型的目的就是提供一种能提高光耦合效率和稳定性，提高系统容差，使之适于批量生产，并且能消除上述光纤内反射光的半导体激光器输出的光学耦合装置。

本实用新型的技术解决方案是：一种半导体激光器输出的光学耦合装置，具有两个透镜，第一个用于收集发射光并准直，第二个用于聚焦并连接光纤头；其特征在于使用两个光学透镜，并且透镜之间有一个光学隔离器。

所说的第一和第二个透镜是自聚焦透镜，透镜周期（pitch）分别为 0.18 和 0.23。

所说的第一个透镜是球透镜或非球面透镜。

所说的各光学元件的定位用激光焊接。

所说的第二个透镜的出射面和光纤端面的倾角相同。

以下结合附图对于本实用新型加以详细的说明。图 1 所示的是本实用新型半导体激光器输出的光学耦合装置的一个实施例结构示意图。图 1 中（1）是激光器管芯、（2）是第一透

镜，本实施例中是一个自聚焦透镜球透镜，（ 3 ）是光学隔离器，（ 4 ）是第二透镜，（ 5 ）是单模光纤头，（ 6 ）是固定套筒，（ 7 ）是外封装壳，（ 8 ）是隔离器支架，（ 9 ）是透镜底座，（ 10 ）是温度控制冷却器（ TEC ），本实施例中是半导体制冷器，，（ 11 ）是激光器的热沉，（ 12 ）是透镜支架。图 2 是另一个实施例，其中的第一透镜（ 2 ）是球透镜。

本实用新型应用两个透镜，第一透镜将半导体激光器的光收集并准直，或接近准直，形成一个 0.5 毫米左右的光束。此准直光束通过一个光学隔离器，然后用第二透镜对光束进行聚焦，并将光纤端面置于焦点，从而达到将光束耦合进光纤的目的。为了减少光的后向反射，所有光学界面都镀有相应波长的增透膜，并且将第二透镜的出射面和光纤入射端加工成相同的角度。从而大大减少了后向反射光，提高了器件的性能。

第一个透镜可采用自聚焦透镜，也可以采用非球面透镜，透镜与激光器的相对位置，经精确调整后以激光焊接定位。透镜与金属外套经环氧树脂粘接或锡焊，外套与支架由激光器焊接定位。

光学隔离器由机加工精度保证定位，经调整后并由胶粘保证位置和偏振方向的正确。

第二透镜的出射面与光纤头入射面均加工成与轴向有一夹角，约 6 至 9 度并镀增透膜，以减少反射。

第二透镜与光纤头配合调整，并用胶粘或锡焊方法与金属外套连接定位。

在激光器输出光经过的各光学表面镀与激光器相应波长的增透膜。

本实用新型由于在分别采用 0.18 和 0.23 的自聚焦透镜为第一和第二透镜，或以非球面或球透镜与周期为 0.18 和 0.23 的自聚焦透镜配调，提高了系统稳定性，增加了容差，使采用本实用新型的激光模块更适于大量生产，两个透镜之间置入光学隔离器，使光纤一端的反射和散射光不能再进入激光器一端，进一步提高了激光器工作的稳定性，又由于各光学表面有激光器波长的增透膜，进一步减少反射光，提高了信号-躁声比。

虽然本实用新型是用上述的实施例和附图加以说明的，本实用新型并不限于实施例和附图，凡是本领域的技术人员看过

本实用新型说明书后，所能想到的任何本实用新型的变形方案，都应当看成是在本实用新型的保护范围之内。

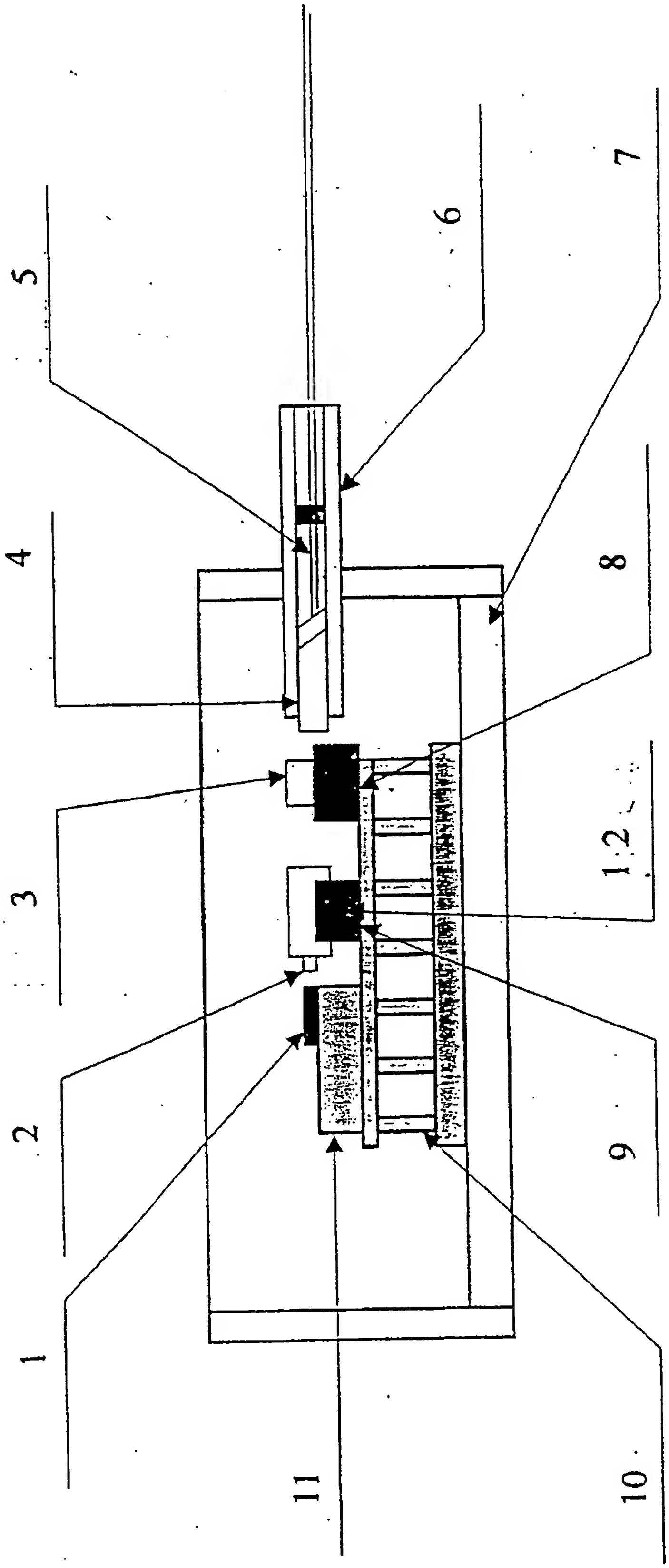

图1

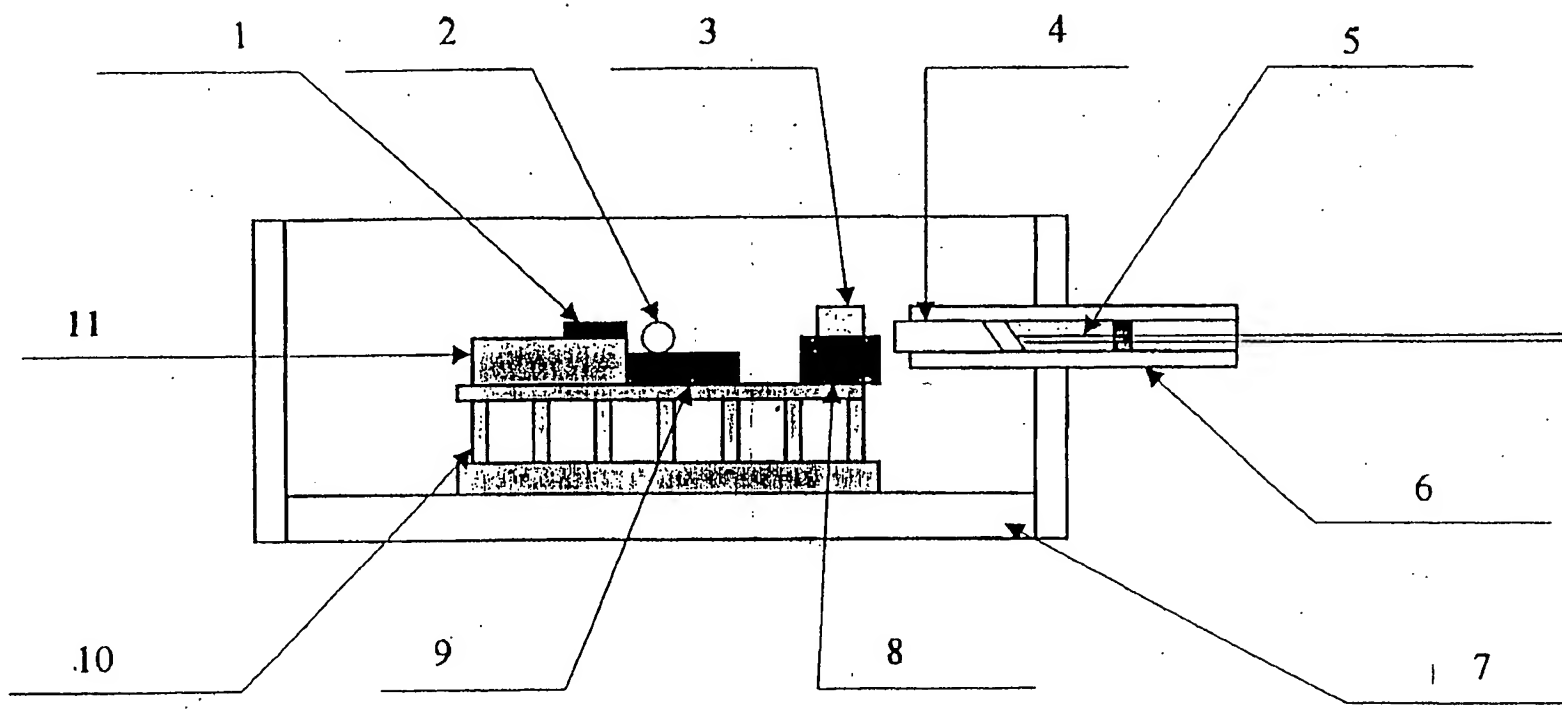

图 2

Abstract

An optical coupler of the output of a semiconductor laser device, comprising two lens, with one for collecting the emitted light and collimating, and the other for focusing and connecting the optical fiber head; an optical isolator is provided between the first lens and the second lens, which makes the reflected and scatter light in the optical fiber unable to enter the laser, so that the stability and signal-to-noise ratio of the laser device could be increased.

Claims

1. An optical coupling means of the output of a semiconductor laser device, comprising two lens, the first lens is used for collecting the emitted light and collimating it and the second lens is used for focusing and connecting the optical fiber head; characterized using two optical lenses and an optical isolator is provided between the lenses.

2. An optical coupling means of the output of a semiconductor laser device as stated in claim 1, characterized in that said first and second lenses are self-focusing lenses, and the pitches of said lenses are 0.18 and 0.23, respectively.

3. An optical coupling means of the output of a semiconductor laser device as stated in claim 1, characterized in that said first lens is a spherical lens or an aspherical lens.

4. An optical coupling means of the output of a semiconductor laser device as stated in claim 1, characterized in that the positioning of each of said optical elements is welded by laser light.

5. An optical coupling means of the output of a semiconductor laser device as stated in claim 1, characterized in that the exit surface of said second lens has the same obliquity as the end surface of the optical fiber.

6. An optical coupling means of the output of a semiconductor laser device as stated in claim 1, characterized in that said obliquity is 6-9°.

7. An optical coupling means of the output of a semiconductor laser device as stated in claim 1, characterized in that the optical surfaces that the laser light output passes through are plated with anti-reflection film that is corresponding to the wavelength of the laser device.

Optical Coupling Means of the Output of a Semiconductor Laser Device

The present utility model pertains to the field of optical fiber communication, and more particularly, it relates to the optical coupling means between the semiconductor laser output and the pigtail fiber.

The semiconductor laser device is generally used in the optical fiber communication field as the emitting source, and it is a key device for converting electrical signal into optical signal in optical communication system and plays a crucial role in the optical communication technique. The output light of the semiconductor laser device has a relatively large diffuse angle, so the there must be an optical coupling means between the output light and the optical tail fiber, and such optical coupling encapsulation is also an importance technique affecting the performance of the whole device. Especially in the high-speed distribution feedback type (DFB) laser device module used for optical communication, the requirements on the stability of the optical spectrum and signal are very strict. A general requirement on said optical coupling means is that the output light of the laser device, i.e., the information light wave, couples into the optical fiber as much as possible, and the backward scattered light and reflected light couple back into the laser device as less as possible. A common coupling means of semiconductor laser device output uses optical lens for converging light beams, and some coupling means use two lenses, one for light collimating and the other for light focusing. However, we found that such laser output coupling means with two lenses usually has poor stability, and the processing technology thereof is hard to control, meanwhile, the reflected light in the optical fiber will enter the laser device to affect the working stability of the laser device. The object of the present utility model is to provide an optical coupling means of the output of the semiconductor laser device that could improve the light coupling efficiency and stability, increase the system tolerance and is suitable for mass production, and could eliminate the reflected light in the above-mentioned optical fiber.

The technical solution of the present utility model is that an optical coupling means of the output of a semiconductor laser device, comprising

two lens, the first lens is used for collecting the emitted light and collimating it and the second lens is used for focusing and connecting the optical fiber head; characterized in using two optical lenses and an optical isolator is provided between the lenses.

Said first and second lenses are self-focusing lenses, and the pitches of said lenses are 0.18 and 0.23, respectively.

Said first lens is a spherical lens or an aspherical lens.

The positioning of each of said optical elements is welded by laser light.

The exit surface of said second lens has the same obliquity as the end surface of the optical fiber.

The present utility model will be illustrated in detail with reference to the drawings in the following. Fig. 1 is a schematic drawing showing the structure of an embodiment of the optical coupling means of the output of a semiconductor laser device of the present utility model. In Fig. 1, (1) is the laser device die; (2) is the first lens, and it is a self-focusing spherical lens in the present embodiment; (3) is the optical isolator; (4) is the second lens; (5) is the single mode fiber header; (6) is the fixing sleeve; (7) is the external enveloping housing; (8) is the isolator supporting frame; (9) is the lens base; (10) is the temperature control cooling device (TEC) and it is the semiconductor refrigerating device; (11) is the heat sink of the laser device; (12) is the supporting frame of the lens. Fig. 2 shows another embodiment, wherein the first lens (2) is a spherical lens.

The present utility model adopts two lenses, the first lens collects the light of the semiconductor laser device and collimates or almost collimates it so as to form a light beam of 0.5 mm. Said collimated light beam goes through an optical isolator and is focused by the second lens, and the end surface of the optical fiber is placed on the focal point to achieve the object of coupling the light beam into the optical fiber. In order to reduce back reflection of light, all the optical interfaces are plated with anti-reflection film of the corresponding wavelength, and the exit

surface of the second lens and the incident end of the optical fiber are made to have the same angle, thereby, the back reflection of light is greatly reduced and the performance of devices are improved.

The first lens could be either self-focusing lens or aspherical lens, and the relative positions of the lens and the laser device are adjusted precisely and then fixed by laser welding. The lens and the metal sleeve are sticked together by epoxide resin or by tin soldering, and the sleeve and the supporting frame are positioned by laser device welding.

The optical isolator is positioned by machining precision and after adjusting, the correctness of the position and polarization direction is ensured by bounding.

The exit surface of the second lens and the incident surface of the optical fiber head are both made to have an included angle about 6-9° with the axis, and they are plated with anti-reflection film to reduce reflection.

The second lens is adjusted coordinately with the optical fiber head and is connected to the metal sleeve by means of bounding or tin soldering and then is positioned.

The optical surfaces that the output light of the laser device passes through are plated with anti-reflection film that has a wavelength corresponding to the laser device.

The present utility model adopts the self-focusing lenses having pitches of 0.18 and 0.23 as the first and second lens, or it uses the aspherical or spherical lens to cooperate with the self-focusing lenses having pitches of 0.18 and 0.23, so it improves the stability of the system, increases the tolerance and makes the laser module using the present utility model more suitable for mass production; meanwhile, the application of an optical isolator between two lenses makes the reflected and scattered light at one end of the optical fiber unable to enter one end of the laser device, so that the working stability of the laser device is further improved; moreover, since there is an anti-reflection film that has a wavelength

corresponding to the laser device on each optical surface, the reflecting light is further reduced and the signal-to-noise ratio is increased.

Although the present utility model is illustrated by the above embodiments and figures, it is not limited to said embodiments and figures. All the variations of the solution of the present utility model contemplated by those skilled in the art after reading this specification should be within the protection scope of the present utility model.